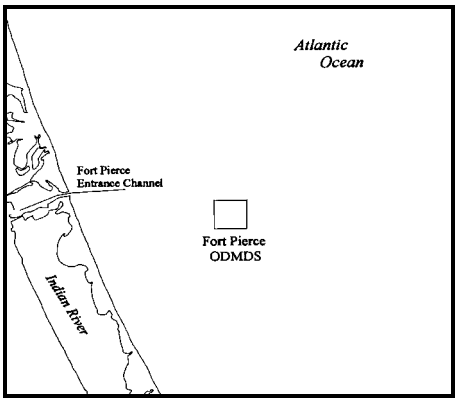
MARCH 2000

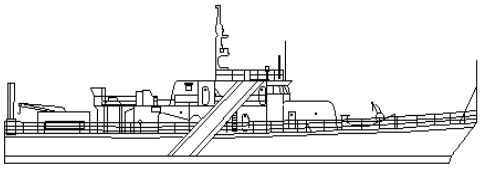
EPA

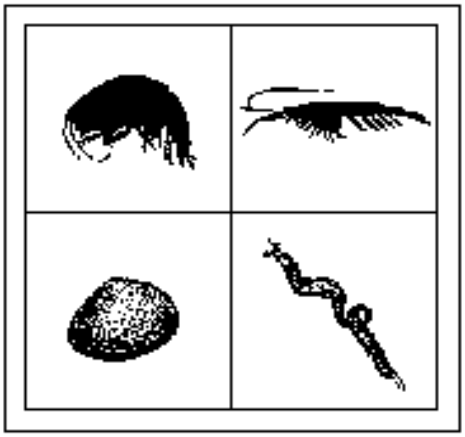
U.S. Army Corps
of Engineers

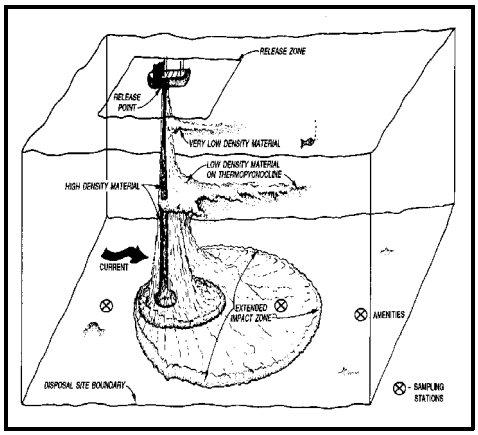
FORT PIERCE
OCEAN DREDGED MATERIAL DISPOSAL SITE

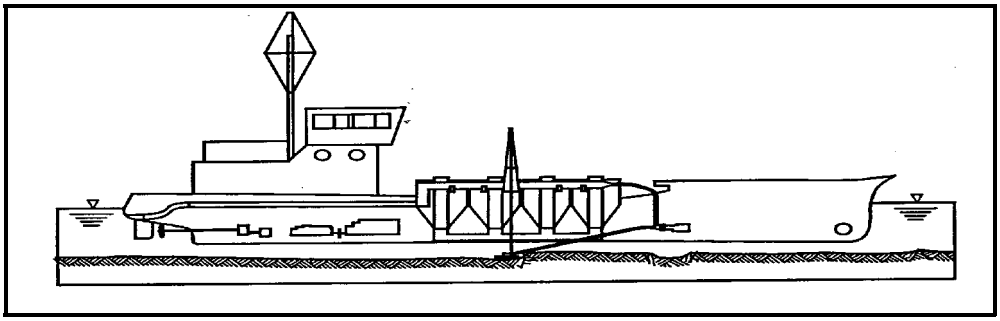
SITE MANAGEMENT AND MONITORING PLAN











The following Site Management and Monitoring Plan for the Fort Pierce ODMDS has been developed and agreed to pursuant to the Water Resources Development Act Amendments of 1992 (WRDA 92) to the Marine Protection, Research, and Sanctuaries Act of 1972 for the management and monitoring of ocean disposal activities, as resources allow, by the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers.

5-3-00

Joe Miller Date
Colonel, U.S. Army
District Engineer
Jacksonville District
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, Florida

APR 2 0 2000

for Robert F. McGhee Date
Director
Water Management Division
U.S. Environmental Protection Agency
Region 4
Atlanta, Georgia

This plan is effective from the date of signature for a period not to exceed 10 years. The plan shall be reviewed and revised more frequently if site use and conditions at site indicate a need for revision.

RICHARD E. BONNER, P. E.
Deputy District Engineer
for Project Management

FORT PIERCE OCEAN DREDGED MATERIAL DISPOSAL SITE (ODMDS)
SITE MANAGEMENT AND MONITORING PLAN

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INTRODUCTION

It is the responsibility of the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (COE) under the Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972 to manage and monitor each of the Ocean Dredged Material Disposal Sites (ODMDSs) designated by the EPA pursuant to Section 102 of MPRSA. MPRSA, the Water Resources Development Act (WRDA) of 1992, and a Memorandum of Agreement between EPA and COE require the development of a site management and monitoring plan (SMMP) to specifically address the disposal of dredged material at the Fort Pierce ODMDS. SMMP provisions shall be requirements for all dredged material disposal activities at the site. All Section 103 (MPRSA) ocean disposal permits or evaluations shall be conditioned as necessary to assure consistency with the SMMP.

A SMMP was developed for the Fort Pierce ODMDS has part of the final site designation in 1993 (EPA, 1993). This plan serves as a revision to and supersedes the original plan.

Site Management and Monitoring Plan Team. An interagency SMMP team has been established to assist EPA and COE in finalizing this SMMP. The team consists of the following agencies and their respective representatives:

Jacksonville District Corps of Engineers

State of Florida

EPA Region 4

Port of Fort Pierce

Fish and Wildlife Service (FWS)

NOAA

Other agencies such as the National Marine Fisheries Service (NMFS) and U.S. Coast Guard will be asked to participate where appropriate. The SMMP team will assist EPA in evaluating existing monitoring data, the type of disposal (i.e., O&M vs. construction), the type of material (i.e., sand vs. mud), location of placement within the ODMDS and quantity of material. The team will assist EPA and COE on deciding on appropriate monitoring techniques, the level of monitoring, the significance of results and potential management options.

SITE MANAGEMENT

Section 228.3 of the Ocean Dumping Regulations (40 CFR 220-229) states: "Management of a site consists of regulating times, rates, and methods of disposal and quantities and types of materials disposed of; developing and maintaining effective ambient monitoring programs for the site; conducting disposal site evaluation studies; and recommending modifications in site use and/or designation." This plan may be modified if it is determined that such changes are warranted as a result of information obtained during the monitoring process.

Disposal Site Characteristics

The Fort Pierce ODMDS is a 1 nmi by 1 nmi square area centered at the coordinates 27º 27.50'N latitude and 80º 12.00'W longitude. The corner coordinates are as follows:

27º27.00'N	80º11.45'W
27º27.00'N	80º12.55'W
27º28.00'N	80º11.45'W
27º28.00'N	80º12.55'W

The site (see Figure 1) is 4.5 nmi offshore, has a depth range of 12 to 16 meters (40 to 55 feet), and an area of 1 nmi^2.

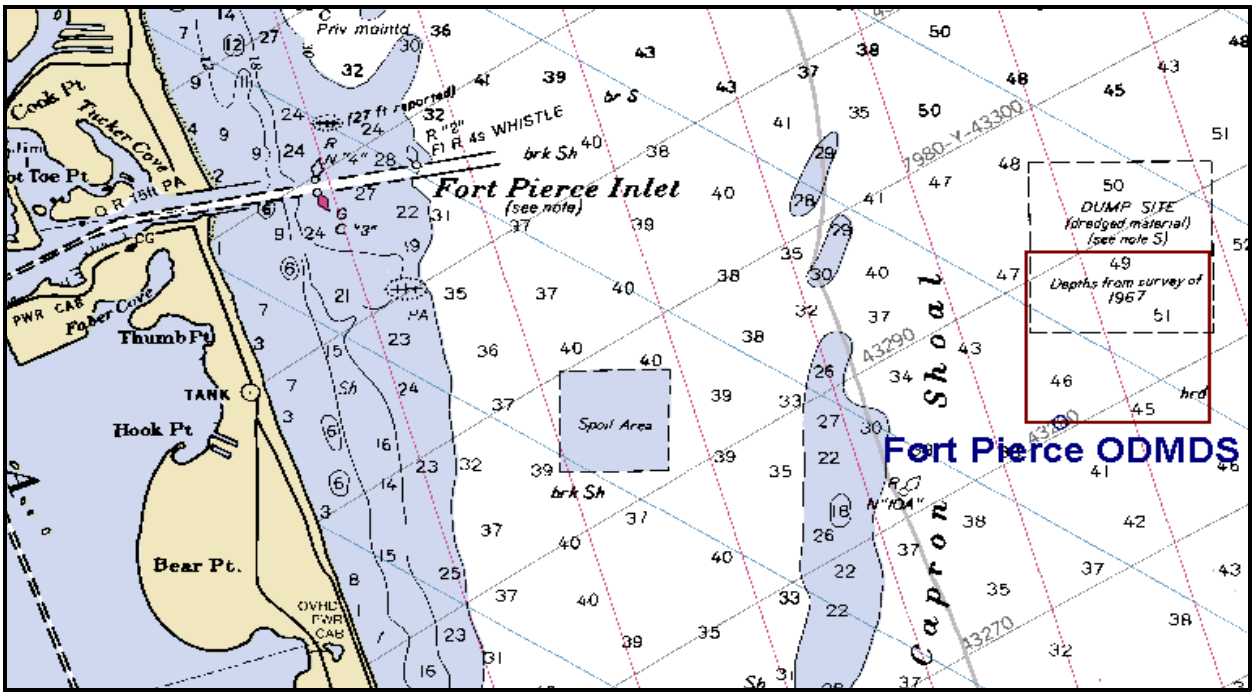

Figure 1: Fort Pierce ODMDS Location Map

Management Objectives. There are three primary objectives in the management of each ODMDS. These are:

- o Protection of the marine environment;
- o Beneficial use of dredged material whenever practical; and
- o Documentation of disposal activities at the ODMDS.

The following sections provide the framework for meeting these objectives to the extent possible.

Material Volumes. The Fort Pierce ODMDS and vicinity has been used for disposal of dredged material since 1949. Since that time about 1.7 million cubic yards of material has been placed at the site, or an average of about 34,000 per year. Prior to site designation in 1993, disposal occurred at the interim site centered one half mile north of the center of the final designated site. Table 1 outlines the history of disposal dredged material at the Fort Pierce ODMDS. Annual and cumulative disposal volumes are shown in figures 2 and 3 respectively.

Table 1. Volume of Dredged Material Placed in the Fort Pierce ODMDS

Year	Volume (cubic yards)	Composition
1949	164,423	Unknown
Not known	63,412	Unknown
Not known	153,190	Unknown
1955	76,700	Unknown
1956-57	73,656	Unknown
1958	6,587	Unknown
1959	23,988	Unknown
1966	184,916	Unknown
1974	12,276	Sand
1976	14,566	Sand
1980	14,592	Sand/Shell
1982-83	106,268	Silty Sand
1985	11,000	Shell/Sand
1993-94	77,000	Silty Sand
1995	724,000	Clays, Silts and Sand

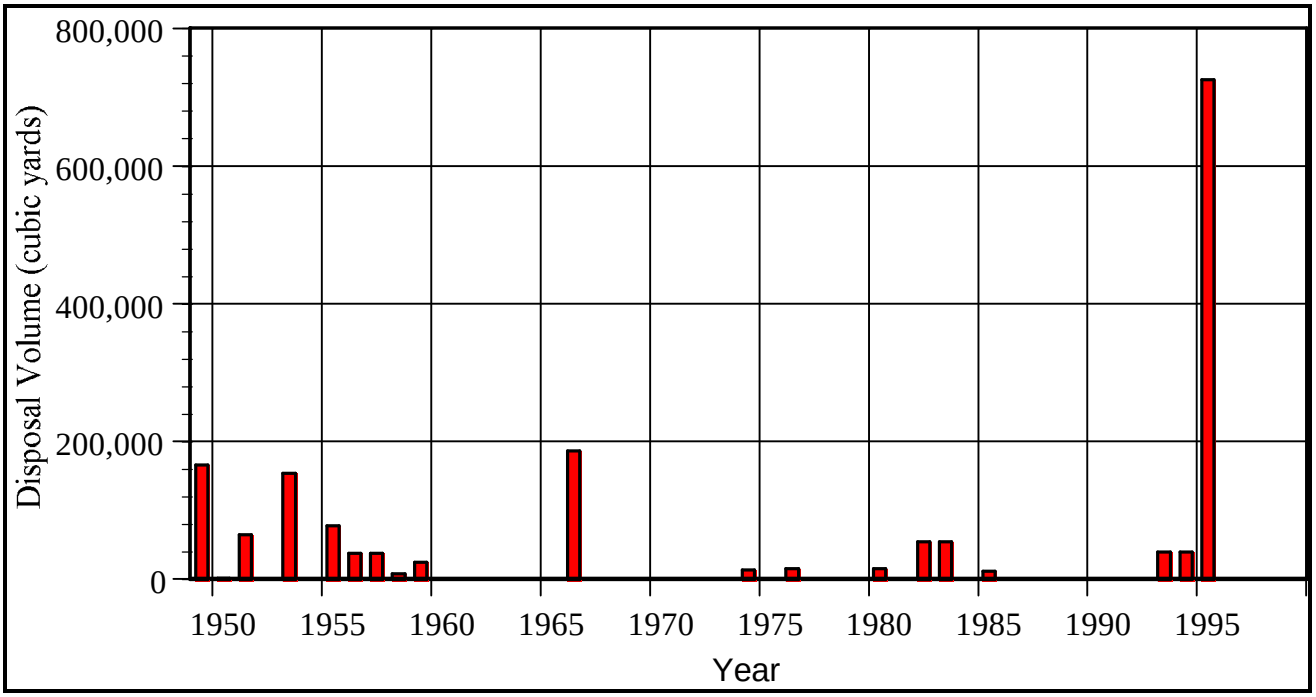

Figure 2: Annual Volume of Dredged Material Placed at the Fort Pierce ODMDS

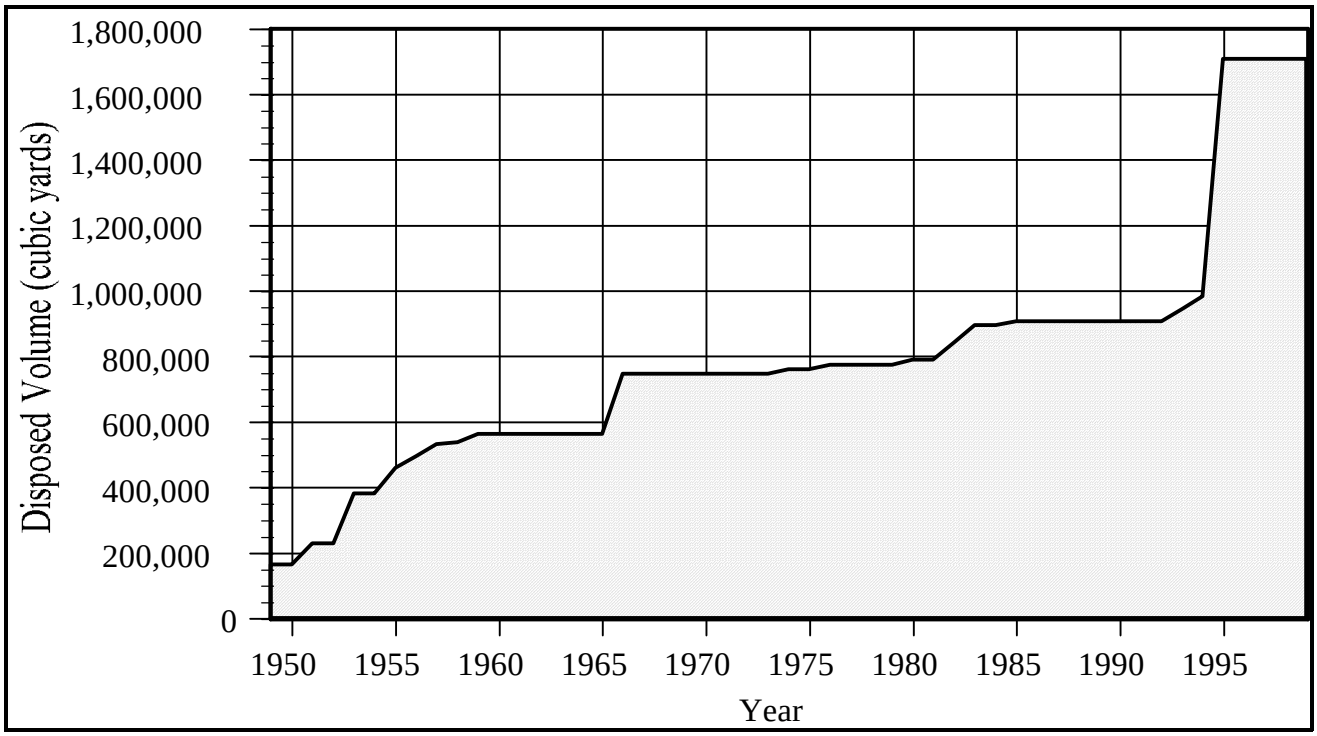

Figure 3: Volume of Dredged Material Placed at the Fort Pierce ODMDS

The Jacksonville District Corps of Engineers has projected disposal of approximately 65,000 cubic yards every 3 to 5 years for the maintenance of the Fort Pierce Harbor channel and turning basin. The capacity of the Fort Pierce ODMDS has been estimated at greater than 10 million cubic yards providing capacity well beyond the foreseeable future (EPA, 1999). If use projections increase significantly, a more detailed analysis of the site capacity should be investigated.

Material Suitability. Material from Fort Pierce Harbor is predominately sand with some silts and clays. It is expected that most material disposed at the site will be maintenance material that is not suitable for beach nourishment. The disposition of dredged material from future projects will be determined during permitting activities for any such projects. It is expected that the State of Florida will exercise its authority and responsibility, regarding beach nourishment, to the full extent during any future permitting activities. Utilization of any significant quantities of beach compatible dredged material for beach nourishment is strongly encouraged and supported by EPA. Disposal of non-beach quality sand should be planned to allow the material to be placed so that it will be within or accessible to the sand-sharing system, to the maximum extent practical, and following the provisions of the Clean Water Act. Disposal of coarser material, such as rubble, should be coordinated with the State of Florida and EPA to avoid unintended impacts in the ODMDS and to promote possible beneficial uses of the material.
The suitability of dredged material for ocean disposal must be verified by the COE and agreed to (concurred) by EPA prior to disposal. Verification will be valid for three years from the time last verified. Verification will involve: 1) a case-specific evaluation against the exclusion criteria (40 CFR 227.13(b)), 2) a determination of the necessity for testing including bioassay (toxicity and bioaccumulation) testing for non-excluded material based on the potential for contamination of the sediment since last tested, and 3) carrying out the testing (where needed) and determining that the non-excluded, tested material is suitable for ocean disposal.

Documentation of verification will be completed prior to use of the site. Documentation will be in the form of a MPRSA Section 103 Evaluation. The Evaluation and any testing will follow the procedures outlined in the 1991 EPA/COE Dredged Material Testing Manual and 1993 Regional Implementation Manual (RIM). This includes how dredging projects will be subdivided into project segments for sampling and analysis. The MPRSA Section 103 Evaluation will be in the form outlined in Appendix B of the RIM. Water Quality Compliance determinations will be made using the STFATE (ADDAMS) model and the input parameters provided in Appendix A. Only material determined to be suitable through the verification process by the COE and EPA will be placed at the Fort Pierce ODMDS.

Time of disposal. At present no restrictions have been determined to be necessary for disposal related to seasonal variations in ocean current or biotic activity. As monitoring results are compiled, should any such restrictions appear necessary, disposal activities will be scheduled so as to avoid adverse impacts. Additionally, if new information indicates that endangered or threatened species are being adversely impacted, restrictions may be incurred.

Disposal Technique. Standard surveillance and evasive measures to protect sea turtles and marine mammals shall be employed during all disposal operations at the ODMDS.

Disposal Location. Prior to disposal of each dredging project, an agreement will be reached between the EPA and COE concerning the placement for each project with permits/contracts specifying the exact locations for disposal. The exact location will be included as part of the MPRSA 103 Evaluation. Fine grained materials will be placed in the southeastern corner in accordance with Figure 4 to afford greater protection of live bottoms to the northwest. Fine grained material is defined as material consisting of greater than 10% fines (grain size of less than 0.047mm) by weight.

For disposal within the restricted area, disposal should occur at least 500 feet inside the disposal site boundaries. Modeling efforts have shown that this release zone will contain the initial disposal mound within the site boundaries for projects up to 1 million cubic yards (EPA, 1999). For projects greater than 1,00,000 cubic yards, modeling will be required to determine an appropriate disposal zone to contain the initial disposal mound within the ODMDS boundaries.

For disposal within the unrestricted area, disposal should occur no less than 330 feet (100 meters) inside the site boundaries to comply with 40 CFR §227.28. For projects greater than 200,000 cubic yards, additional analysis will be required to determine the appropriate disposal zone.

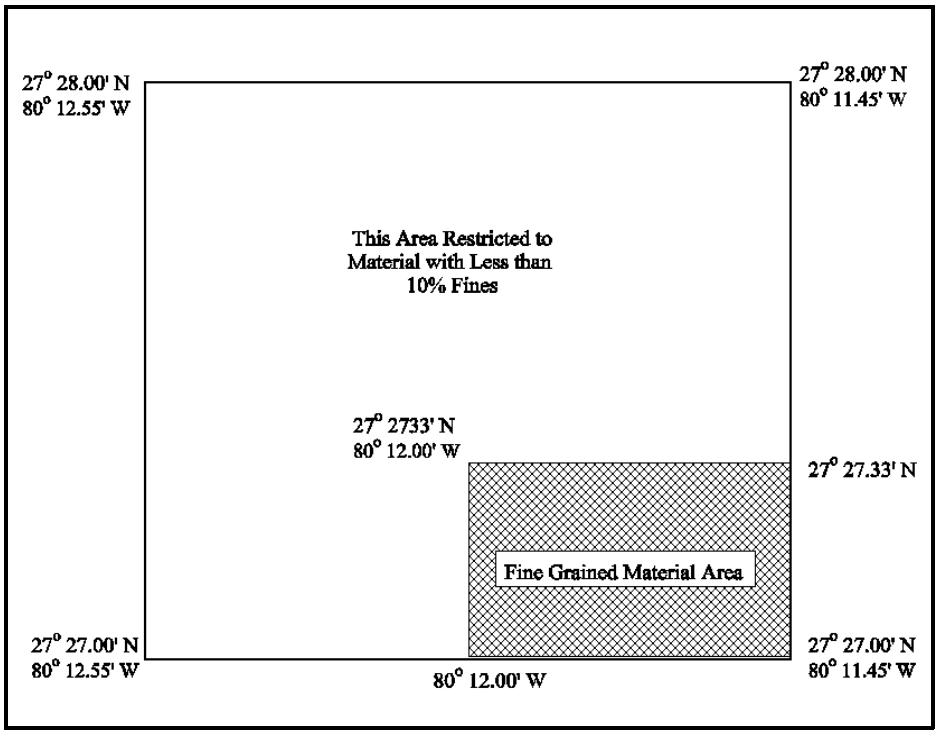

Figure 4: Fort Pierce ODMDS Dredged Material Placement Requirements

Permit and Contract Conditions. The disposal monitoring and post-disposal monitoring requirements described under Site Monitoring will be included with the management requirements described in this section as permit conditions on all MPRSA Section 103 permits and will be incorporated in the contract language for all federal projects. A summary of the management and monitoring requirements to be included are listed in Table 2.

Table 2. Summary of Permit and Contract Conditions

Condition	Reference
Dredged Material Suitability and Term of Verification	Fort Pierce ODMDS SMMP page 5 Regional Implementation Manual
Disposal Location	Fort Pierce ODMDS SMMP page 6
Pre and Post Bathymetric Surveys	Fort Pierce ODMDS SMMP page 9 and 10
Disposal Monitoring	Fort Pierce ODMDS SMMP page 9
Reporting Requirements	Fort Pierce ODMDS SMMP page 14

SITE MONITORING

The MPRSA establishes the need for including a monitoring program as part of the Site Management Plan. Site monitoring is conducted to ensure the environmental integrity of a disposal site and the areas surrounding the site and to verify compliance with the site designation criteria, any special management conditions, and with permit requirements. Monitoring programs should be flexible, cost effective, and based on scientifically sound procedures and methods to meet site-specific monitoring needs. The intent of the program is to provide the following:

(1) Information indicating whether the disposal activities are occurring in compliance with the permit and site restrictions; and/or

(2) Information concerning the short-term and long-term environmental impacts of the disposal; and/or

(3) Information indicating the short-term and long-term fate of materials disposed of in the marine environment.

The main purpose of a disposal site monitoring program is to determine whether dredged material site management practices, including disposal operations, at the site need to be changed to avoid significant adverse impacts.

Baseline Monitoring. The results of investigations presented in the designation EIS will serve as the main body of baseline data for the monitoring of the impacts associated with the use of the Fort Pierce ODMDS (see Table 3).

Table 3. Surveys and Studies Conducted at the Fort Pierce ODMDS Prior to Site Designation

Survey Title	Conducted by	Date	Purpose	Conclusion
Environmental Survey in the Vicinity of An ODMDS Fort Pierce Harbor, Florida	Conservation Consultants, Inc. for COE	1985	Characterization Survey (water and sediment quality, bathymetry, benthic macroinvertebrate, meiofauna and macroepifauna analysis and tissue analysis)	
Evaluation of the Dispersion Characteristics of the Miami and Fort Pierce ODMDSs	COE WES	1989	Determine if disposal at site poses threat to sensitive nearshore reef areas due to short term or long term transport.	Most material settles to the bottom within hours of disposal; sediment will be transported from the site during both ambient and storm conditions, but the rate of movement should not effect the reef system.
Short-Term Modeling Worst Case Sediment Scenario Fort Pierce ODMDS	U.S. EPA Region 4	1992	Model short term dispersion of 90% silt and clay dredged material	Under worst case conditions, the disposal plume could reach live bottom communities at concentrations below 10mg/l for short durations.
Fort Pierce, Florida ODMDS Video Mapping Survey	U.S. EPA Region 4	1991	Insure absence of live bottom habitat within site boundaries	Live bottom habitat identified in northern portion of site. Site was moved ½ mile south to avoid disposal on this habitat.
Mapping of Sediment Chemistry at the Proposed Fort Pierce, Florida ODMDS	CAIS for U.S. EPA Region 4	1992	Provide baseline sediment lithology within and immediately surrounding the ODMDS	Sediment lithology is very uniform in gamma activity, elemental, and physical content.
Ft. Pierce Harbor, FL ODMDS Benthic Communities	Barry Vittor & Assoc. for U.S. EPA Region 4	1993	Provide baseline of benthic communities at the ODMDS	Species abundance, diversity, evenness, and richness was high at all stations. Annelids, echinoderms, and arthropods accounted for the greatest proportion of individuals.

A bathymetric survey will be conducted by the COE or site user not more than 90 days prior to dredging cycle or project disposal for projects greater than 50,000 cubic yards. Projects less than 50,000 cubic yards are not expected to greater changes in bathymetry greater than 1 foot (EPA, 1999) and therefore will not require a bathymetry survey unless it has been more than five years since the last survey. The number of transects required will be dependent upon the length of the disposal operation and the quantity of material proposed for disposal. The surveys will be taken along lines spaced at 200-foot intervals or less and be of sufficient length to adequately cover the disposal area. Accuracy of the surveys will be $\pm$ 0.5 feet. Horizontal location of the survey lines and depth sounding points will be determined by an automated positioning system utilizing either a microwave line of site system or differential global positioning system. The vertical datum shall be mean lower low water (m.l.l.w.) and the horizontal datum Florida State Plane or Geographic (NAD 1983 or NAD 1927). No additional pre-disposal monitoring at this site is required.

Disposal Monitoring. For all disposal activities, the dredging contractor will be required to prepare and operate under an approved electronic verification plan for all disposal operations and notify EPA Region 4 by letter prior to commencement of disposal activities. As part of this plan, the contractor will provide an automated system that will continuously track the horizontal location of the disposal vessel from the point of dredging to the disposal area, and return to the point of dredging. Required digital data are as follows:

(a) Date;

(b) Time;

(c) Vessel Name;

(d) Captain of Vessel;

(e) Date, time and beginning and ending coordinates of the dredging area for each load (source of material disposed);

(f) Scow or hopper position, every five (5) minutes, from the dredging site through completion of the disposal event;

(g) Actual location and date/time at points of initiation and completion of disposal.

(h) Volume of material disposed; and

(i) Brief Description of material disposed

(j) Disposal technique used.

The user will be required to prepare and submit to the COE daily reports of operations and a monthly report of operations for each month or partial month's work. The user is also required to notify the COE and the EPA if a violation of the permit and/or contract conditions occur during disposal operations.

Post Discharge Monitoring. As a follow-up to the pre-disposal bathymetric survey, the COE or other site user will conduct a bathymetric survey within 30 days after disposal project completion. The number of transects required will be the same as in the pre-disposal survey. Post-disposal surveys will be required whenever a pre-disposal survey was conducted. Bathymetric surveys will be used to monitor the disposal mound to insure a navigation hazard is not produced, to assist in verification of material placement, to monitor bathymetric changes and trends, to aid in environmental effects monitoring and to insure that the site capacity is not exceeded, ie. , the mound does not exceed the site boundaries. Copies of these surveys shall be provided to EPA Region 4 when completed.

Material Tracking and Disposal Effects Monitoring Surveys can be used to address possible changes in bathymetric, sedimentological, chemical, and biological aspects of the ODMDS and surrounding area as a result of the disposal of dredged material at the site.

Summary of Results of Past Monitoring Surveys

Surveys conducted at the Fort Pierce ODMDS since site designation are listed in Table 4. The Fort Pierce Harbor Navigation Improvement Project in 1995 disposed of significant (724,000 cubic yards) amounts of dredged material at the ODMDS. Post disposal surveys have shown that a significant mound was formed as a results of the disposal. However, this mound has remained relatively stable and within the boundaries of the ODMDS. The amount of fines on the bottom surface increased after disposal in and outside the disposal boundaries and has subsequently decreased.

Future Monitoring Surveys

Based on the type and volume of material disposed and impacts of concern, various monitoring surveys can be used to determine if and where the disposed material is moving, and what environmental effect the material is having on the site and adjacent areas.

A summary of the monitoring strategies for the Fort Pierce ODMDS and thresholds for management actions are presented in Table 5. Should future disposal at the Fort Pierce ODMDS result in unacceptable adverse impacts, further studies may be required to determine the persistence of these impacts, the extent of the impacts within the marine system, and/or possible means of mitigation. In addition, the management plan presented may require revision based on the outcome of any monitoring program.

Table 4. Surveys and Studies Conducted at the Fort Pierce ODMDS Since Designation and SMMP Implementation

Survey Title	Conducted by	Date	Purpose	Conclusion
Bathymetry Survey of the Fort Pierce Interim Site	COE	1994	Post disposal bathymetry survey following channel maintenance	
Fort Pierce, FL Dredge Material Discharge Study	NOAA for COE	1994	Measure transport and dilution of disposal plume	Dredged material descended quickly in a cohesive mass and formed a residual plume that decayed to 37% of it's initial value within 4 minutes.
Areal Mapping of Sediment Chemistry at the Fort Pierce, FL ODMDS.	CAIS for EPA Region 4	1994	Post disposal survey following channel maintenance	Minimal change at the site since the 1992 survey. Increase in the coarse particle size fraction. Inconclusive evidence of disposed dredged material at the site.
Bathymetry Survey of the Fort Pierce ODMDS	COE	1996	Post disposal bathymetry survey following Harbor Improvement Project	Three (3) foot mound identified in western half of ODMDS
Post Disposal Areal Mapping of Sediment Chemistry at the Fort Pierce, FL ODMDS.	CAIS for EPA Region 4	1997	Post disposal survey following Harbor Improvement Project	Gamma activity indicated a dredged material mound covering most of the western half of the ODMDS. An increase in the amount of fines at the bottom surface was detected throughout the site.
Preliminary Evaluation of Trace Metals and Radionuclides in Harbor and Shelf Sediments off Fort Pierce, Florida	U.S. EPA Region 4 for COE	1997	Examine deposits on nearby reefs and compare to harbor and disposal site sediments to try and identify source of reef deposits.	Reef deposits were dissimilar to harbor sediments and sediments found at the ODMDS suggesting that the reef sediment deposits are not comprised of disposed dredged material.
Post Disposal Areal Mapping of Sediment Chemistry at the Fort Pierce, FL ODMDS.	CAIS for EPA Region 4	1998	Document changes and movement of disposed dredged material.	Disposed dredged material persists within the ODMDS and does not appear to be moving significantly.. A decrease in the amount of fines at the bottom surface was detected throughout the site indicating a loss of fines at the site.
Ft. Pierce Harbor, FL ODMDS Sidescan Sonar Survey	EPA Region 4	1999	Examine southern portion of site for presence of hard bottom habitats and detect location of fine grained sediments within and near the ODMDS.	No significant hard bottom resources were detected in the southern portions of the ODMDS. Dredged material identified in patches in area of disposal and north and south of this area.
Ft. Pierce Harbor, FL ODMDS Benthic Communities Post Disposal Survey	Barry Vittor & Assoc. for U.S. EPA Region 4	1999	Post disposal benthic effects survey.	Results not yet available

Table 5. Fort Pierce ODMDS Monitoring Strategies and Thresholds for Action

Goal	Technique	Sponsor	Rationale	Frequency	Threshold for Action	Management Options	
						Threshold Not Exceeded	Threshold Exceeded
Monitor Bathymetric Trends & Short Term Fate	Bathymetry	Site User	Determine the extent of the disposal mound and major bathymetric changes	Pre and post disposal *(>50,000 cy or >5yrs)*	Disposal mound occurs outside ODMDS boundaries	Continue Monitoring	-Modify disposal method/placement -Restrict Disposal Volumes
Long Term Fate and Environmental Effects Monitoring	Sediment Mapping (Gamma/CS^3)	EPA	Determine areal influence of dredged material	Completed	Communities under the influence of dredged material outside the site have significant differences in diversity/ richness/biomass from those not under dredged material influence after one year recovery period.	Discontinue monitoring unless disposal quantities, type of material or frequency of use significantly changes	-Limit quantity or types of dredged material to prevent impacts outside boundaries -Create berms to restrict dredged material movement -Cease site use
	Benthic Survey	EPA	Determine impact of dredged material on benthic community	Completed			
Additional Resource Inventory	Sidescan Sonar with Ground-truthing	EPA	Insure no significant live bottom resources near fine grained disposal area	Planned for FY2001	Significant resources found within 1 nmi of fine grained disposal area	No Action	Relocate fine grained disposal area.
Insure Safe Navigation Depth	Bathymetry	Site User	Determine height of mound and any excessive mounding	Pre and Post disposal *(>50,000 cy or >5yrs)*	Mound height > -25 feet m.l.l.w.	Continue Monitoring	-Modify disposal method/placement -Restrict disposal volumes

Table 5 Continued. Fort Pierce ODMDS Monitoring Strategies and Thresholds for Action

Goal	Technique	Sponsor	Rationale	Frequency	Threshold for Action	Management Options	
						Threshold Not Exceeded	Threshold Exceeded
Compliance	Disposal Site Use Records	Site User	-Insure management requirements are being met -To assist in site monitoring	Daily during the project	Disposal records required by SMMP are not submitted or are incomplete	Continue Monitoring	-Restrict site use until requirements are met
					Review of records indicates a dump occurred outside ODMDS boundary	Continue Monitoring	-Notify EPA Region 4/COE, and investigate why egregious dump(s) occurred. Take appropriate enforcement action.
					Review of records indicates a dump occurred in the ODMDS but not in target area	Continue Monitoring	-Direct placement to occur as specified.

In addition to the monitoring strategies presented in Table 5, an effort to investigate the presence and source of fine muddy sediments observed collecting on reef ledges off of St. Lucie County and Fort Pierce, Florida has been initiated. This effort, lead by the NOAA Atlantic Oceanographic and Meteorological Laboratory Remote Sensing Division, is described in Appendix B. If it is determined that the source of this material is the Fort Pierce ODMDS, then appropriate management actions will be implemented. These could include, but would not be limited to, restrictions on disposal volumes, restrictions on types of dredged material, changes in disposal practices, site closure or site relocation.

Reporting and Data Formatting. The user will be required to prepare daily reports of operations and submit to the COE a monthly report of operations for each month or partial month's work. Disposal monitoring data shall be delivered electronically to the COE on a weekly basis. The user is also required to notify the COE and the EPA within 24 hours if a violation of the permit and/or contract conditions related to MPRSA Section 103 or SMMP requirements occur during disposal operations.

Disposal summary reports shall be provided by the COE to EPA within 45 days after project completion. These should consist of dates of disposal, volume of disposal, approximate location of disposal and pre and post disposal bathymetric survey results in both hard and electronic formats. Other disposal monitoring data shall be made available upon request. In addition, EPA should be notified by the Corps of Engineers 15 days prior to the beginning of a dredging cycle or project disposal.

Material tracking, disposal effects monitoring and any other data collected shall be coordinated with and be provided to SMMP team members and federal and state agencies as appropriate. Data will be provided to other interested parties requesting such data to the extent possible. Data will be provided for all surveys in a report generated by the action agency. The report should indicate how the survey relates to the SMMP and previous surveys at the Fort Pierce ODMDS and should provide data interpretations, conclusions, and recommendations, and should project the next phase of the SMMP.

MODIFICATION OF THE FORT PIERCE ODMDS SMMP

Should the results of the monitoring surveys or valid reports from other sources indicate that continued use of the ODMDS would lead to unacceptable effects, then the ODMDS SMMP will be modified to mitigate the adverse impacts. The SMMP will be reviewed and revised if appropriate at a minimum of every ten years. The SMMP will be reviewed and updated as necessary if site use changes significantly. For example, the SMMP will be reviewed if the quantity or type of dredged material placed at the site changes significantly or if conditions at the site indicate a need for revision.

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Appendix A
Water Column Evaluations
Numerical Model (STFATE) Input Parameters

Water Column Evaluations
Numerical Model (STFATE) Input Paramaters
Fort Pierce ODMDS

SITE DESCRIPTION

Parameter	Value	Units
Number of Grid Points (left to right)	32	
Number of Grid Points (top to bottom)	32	
Spacing Between Grid Points (left to right)	250	ft
Spacing Between Grid Points (top to bottom)	250	ft
Constant Water Depth	45	ft
Roughness Height at Bottom of Disposal Site	.005[1]	ft
Slope of Bottom in X-Direction	0	Deg.
Slope of Bottom in Z-Direction	0	Deg.
Number of Points in Ambient Density Profile Point	2	
Ambient Density at Depth = 0 ft	1.0256	g/cc
Ambient Density at Depth = 45 ft	1.0257	g/cc

AMBIENT VELOCITY DATA

Parameter	Value	Units
Water Depth	45	ft
Profile	Logarithmic	
Vertically Averaged X-Direction Velocity	-0.10	ft/sec
Vertically Averaged Z-Direction Velocity	0.0	ft/sec

INPUT, EXCECUTION AND OUTPUT

Parameter	Value	Units
Location of the Upper Left Corner of the Disposal Site - Distance from Top Edge	1,000	ft
Location of the Upper Left Corner of the Disposal Site - Distance from Left Edge	1,000	ft
Location of the Lower Right Corner of the Disposal Site - Distance from Top Edge	7,000	ft
Location of the Lower Right Corner of the Disposal Site - Distance from Left Edge	7,000	ft
Duration of Simulation	14,400	sec
Long Term Time Step	600	sec

DISPOSAL OPERATION DATA - RESTRICTED AREA

Parameter	Value	Units
Location of Disposal Point from Top of Grid	4,000	ft
Location of Disposal Point from Left Edge of Grid	4,000	ft
Dumping Over Depression	0	

DISPOSAL OPERATION DATA - FINE GRAINED MATERIAL AREA

Parameter	Value	Units
Location of Disposal Point from Top of Grid	5,000	ft
Location of Disposal Point from Left Edge of Grid	4,000	ft
Dumping Over Depression	0	

COEFFICIENTS

Parameter	Keyword	Value
Settling Coefficient	BETA	0.000[1]
Apparant Mass Coefficient	CM	1.000[1]
Drag Coefficient	CD	0.500[1]
Form Drag for Collapsing Cloud	CDRAG	1.000[1]
Skin Friction for Collapsing Cloud	CFRIC	0.010[1]
Drag for an Ellipsoidal Wedge	CD3	0.100[1]
Drag for a Plate	CD4	1.000[1]
Friction Between Cloud and Bottom	FRICTN	0.010[1]
4/3 Law Horizontal Diffusion Dissipation Factor	ALAMDA	0.0225[2]
Unstratified Water Vertical Diffusion Coefficient	AKYO	Pritchard Expression
Cloud/Ambient Density Gradient Ratio	GAMA	0.250[1]
Turbulent Thermal Entrainment	ALPHAO	0.235[1]
Entrainment in Collapse	ALPHAC	0.100[1]
Stripping Factor	CSTRIP	0.003[1]

[1]Model Default Value
[2]Calculated from NOAA Field Work (1994)